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U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE NEBRASKA SOIL SURVEY, G. E. CONDRA, DIRECTOR, UNIVERSITY OF NEBRASKA.

SOIL SURVEY OF NEMAHA COUNTY, NEBRASKA.

BY

A. H. MEYER, M. W. BECK, E. H. SMIES, AND R. R. BURN, OF THE U. S. DEPARTMENT OF AGRICULTURE, AND L. T. SKINNER AND W. A. ROCKIE, OF THE NEBRASKA SOIL SURVEY.

CURTIS F. MARBUT, INSPECTOR IN CHARGE.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., October 16, 1915.

SIR: During the field season of 1914 a soil survey was made of Nemaha County, Nebr. This work was done in cooperation with the State of Nebraska, and the selection of the area was made after conference with State officials.

I have the honor to transmit herewith the manuscript report and map covering this area and to recommend their publication as advance sheets of Field Operations of the Bureau of Soils for 1914, as authorized by law.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

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Soil map, Nemaha County sheet, Nebraska.

SOIL SURVEY OF NEMAHA COUNTY, NEBRASKA.

By A. H. MEYER, M. W. BECK, E. H. SMIES, and R. R. BURN, of the U. S. Department of Agriculture, and L. T. SKINNER and W. A. ROCKIE, of the Nebraska Soil Survey.

DESCRIPTION OF THE AREA.

Nemaha County is in the southern part of the eastern tier of counties in Nebraska. It is bounded on the east by the Missouri State line, on the south by Richardson and Pawnee Counties, on the west by Johnson County, and on the north by Otoe County. The eastern boundary is very irregular, and in places the county extends across the Missouri River. The northern, western, and southern boundaries follow straight lines. The county measures 18 miles from north to south; the northern boundary is 19 miles long, and the southern boundary 27.5 miles. The southern boundary is 18 miles north of the Kansas State line. The county has an area of 402 square miles, or 257,280 acres.

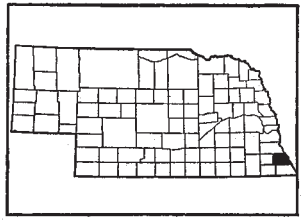

FIG. 59.—Sketch map showing location of the Nemaha County area, Nebraska.

Nemaha County lies within the glaciated part of the physiographic division known as the Great Plains. Erosion and deposition by the streams have produced three main topographic divisions—the uplands, the terraces, and the river bottoms.

The uplands are covered by a superficial deposit of drift and loess which has been more or less eroded, giving a topography that ranges from almost flat to rough and dissected. The flat to gently undulating areas occur in the extreme western and northwestern parts of the county, and apparently represent the original constructional surface of the loess plains. There the streams, which are few in number, are merely slight sags. The remainder of the county is gently rolling to rolling, and the eastern part of the upland region is bounded by the Missouri River bluff. The section of roughest topography is in the extreme southeastern part of the county. The bluff zone is dissected by an intricate stream system with deep V-shaped valleys. The dissection extends to approximately 250 feet below the general level of the plains. The slopes are very steep to precipitous, and have eroded as would soft massive rock. The steplike surface of many of the steep

slopes is a conspicuous feature. In the rolling upland region the main watersheds between the major streams are usually gently sloping, though rarely flat. The slopes along the larger streams are comparatively steep, and where the land is upheld by bedrock they are almost precipitous. Where the Kansan drift proper has been exposed the slopes are steep and uneven, in contrast with the smooth topography where the surface has a loess deposit.

The terraces of Nemaha County are very small in extent and are entirely confined to Little Nemaha Valley. There are two systems of terraces, the first about 30 feet and the second about 60 feet above the flood plain. The lower terrace is best developed at Nemaha and 4 miles southeast of Auburn. It is flat and has very few streams, except those rising in the upland and cutting through it. The high bench occurs 2 miles southeast of Auburn. It is rather flat-topped, though most of the area has been reduced to slopes. A corresponding eroded terrace having an undulating topography is developed one-half mile northwest of Auburn, and another occurs at Spring Valley, extending from the latter place almost to the county line. The two latter terraces are mapped as upland, because of their eroded form. The slope from the low bench to the bottom land is gentle, while that from the high terrace to the bottom land is more pronounced.

Nemaha County includes considerable bottom land, though very little occurs along the Missouri River, owing to the fact that the course of the stream is near the western bluff line. Most of the first bottom along the Missouri River occurs north of Peru, covering about 15 square miles. The largest area of bottom land is along the Little Nemaha River, and varies in width from one-half mile to 3½ miles. Other areas occur along Muddy Creek and Long Branch. The surface of the bottom land is generally flat. The topography of the Missouri River bottoms is relieved by minor depressions, cut-offs, old channels, overflow channels, and intervening sand ridges. The elevation of the bottom land along the Missouri River varies from 908 feet above sea level in the northeastern part of the county to 880 feet in the southeastern part, and along the Little Nemaha River from 980 feet above sea level where it enters the county to 893 feet where it joins the Missouri Valley. The highest point in the county, about 1,320 feet above sea level, occurs about 4 miles southwest of Johnson. The range in elevation in the county is about 440 feet.

Nemaha County is drained by three principal streams, the Missouri and the Little Nemaha Rivers and the branches of the Big Nemaha River. The Missouri River flows a little east of south along the eastern border of the county and drains a narrow area of about 70 square miles. The Little Namaha enters the county in the northwestern part, flows in a southeasterly direction, and joins the Missouri River below the town of Nemaha. This stream originally had

a very crooked course, but it has been straightened by deep ditches throughout its course in Nemaha County. It drains an area of about 219 square miles. The branches of the Big Nemaha River, Muddy Creek and Long Branch, drain about 120 square miles in the southwestern corner of the county. Most of the streams have cut through the loess to the drift, and some of them to bedrock. The general direction of the drainage in Nemaha County is to the southeast.

The first permanent settlement in Nemaha County was made in 1854 at the present site of Brownville. A trading point was established at St. Deroin as early as 1853. During the early history of the region Nemaha County was known as Forney County, its name being changed by the first Territorial legislature. Originally it included most of southeastern Nebraska, but the area was reduced in size a number of times, and about 1858 the present boundaries were established. The county was organized in 1855 and in 1857–58 the legislature made Brownville the county seat. In 1885 the county seat was changed to Auburn. The early settlers were mainly from Missouri, Indiana, and Illinois. In 1860 the population was augmented by Welsh immigrants and in 1865 by Germans. The present population is mainly German, Welsh, and American.

According to the census reports the population of the county was 10,451 in 1880, 12,930 in 1890, 14,952 in 1900, and 13,095, with a rural population of 10,366, or 25.8 persons per square mile, in 1910.

Auburn, the county seat, is located in the center of the county on two railroads and has a population of 2,729, according to the 1910 census. It has a broom factory, flour mill, canning factory, ice plant, cement-block factory, bottling works, 4 grain elevators, brickyards, and 2 cream stations. Peru, the second largest town, with a reported population of 950, is located in the northeastern part of the county. It has several grain elevators and a State normal school. Brownville is an incorporated village with a population of 457, located on the Missouri River in the eastern part of the county. It is noted as a shipping point for apples and has a canning factory, cider factory, and grain elevator. Brock, Nemaha, Johnson, Julian, Howe, and Glenrock are towns of local importance.

Nemaha County has good transportation facilities, no part of it being more than 10 miles from a railroad station. A main line of the Missouri Pacific crosses the county from north to south and gives direct communication with Omaha and Kansas City. From a point 2 miles north of Auburn the Talmage branch of the same system extends northwestward, following the Little Nemaha Valley. The Chicago, Burlington & Quincy Railroad (Beatrice line) traverses the county from east to west, having a terminus at Nemaha, where connection is made with the Falls City and Nebraska City lines of the same system, extending north and south, respectively.

The Omaha and Kansas City highway passes through the eastern part of the county. While but little attention is given to the minor roads, the main public roads are kept in good condition. Most of the public roads follow section lines, except in the narrow bluff zone in the eastern part of the county. Practically all the streams, even small draws, are bridged. There are no toll roads in the county.

Omaha, Kansas City, and St. Joseph are the principal markets for live stock, grain, and dairy products.

Practically all parts of the county are supplied with rural mail delivery and telephones are in general use.

CLIMATE.

The climate of Nemaha County varies considerably from one season to another. The winters are fairly long and cold and the summers hot and dry. The springs are usually cool, with considerable rainy weather, and the autumns long and pleasant, with only occasional periods of rainy weather.

The mean annual precipitation, according to the records of the Weather Bureau station at Auburn, which is centrally located in Nemaha County, is 35.63 inches. The precipitation is heaviest during the months of May, June, and July. For the summer months, June, July, and August, it averages 14.44 inches. It is lightest during the winter, with a total of 3 inches for December, January, and February. The greater part of the precipitation in the summer occurs as local storms. The rainfall during May and June is well distributed, periods of drought being practically unknown. In July and August the distribution is less favorable, and in September the rainfall is much lighter, so that long periods of drought occur occasionally within these three months. As a rule the rainfall is adequate for plant needs during the growing season, and where the moisture is properly conserved crops are not seriously injured by drought. Total crop failures do not occur, although the corn crop is sometimes injured by drought and hot winds.

The mean annual temperature is 51.6° F. January and February are the coldest months, with a mean temperature of about 25.6°, and July is the warmest, with a mean temperature of 75.6°, while the average temperature for August is hardly 1° lower. This gives a range in temperature between the means of the warmest and coldest months of about 50°. The lowest temperature ever recorded is —35°, and the highest 109°.

The average date of the last killing frost in the spring is April 27 and of the first in the fall, October 3. The latest recorded date of killing frost in the spring is May 27, and the earliest in the fall, September 13. The average length of the growing season is 159

days. The normal seasons are long enough to insure the successful production of such crops as corn, wheat, oats, and hay.

From April 1 to October 1 the prevailing winds are from the south and from October 1 to April 1 from the northwest. Strong winds are common, though tornadoes are rare.

According to the records at Lincoln, the relative humidity is comparatively uniform. The average annual humidity is about 70 per cent. The same records show an average of 175 to 185 clear days and 81 to 86 cloudy days, the remaining days in the year being partly cloudy.

The following table is compiled from the records of the Weather Bureau station at Auburn:

Normal monthly, seasonal, and annual temperature and precipitation at Auburn.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.
	°F.	°F.	°F.	*Inches.*	*Inches.*	*Inches.*
December	30.2	67	−19	0.96	0.56	2.18
January	25.6	68	−35	0.83	0.33	1.15
February	25.5	79	−35	1.21	1.21	0.09
Winter	27.1			3.00	2.10	3.42
March	39.1	93	−10	1.97	1.87	1.09
April	52.4	100	14	3.12	3.25	0.97
May	61.9	102	22	6.11	2.26	7.23
Spring	51.1			11.20	7.38	9.29
June	71.0	102	40	5.09	4.61	9.42
July	75.6	109	46	4.93	2.43	9.88
August	74.8	104	42	4.42	5.64	3.18
Summer	73.8			14.44	12.68	22.48
September	67.1	101	21	2.97	0.93	4.98
October	55.8	95	16	2.98	0.23	4.75
November	40.4	79	− 9	1.04	1.33	2.57
Fall	54.4			6.99	2.49	12.30
Year	51.6	109	−35	35.63	24.65	47.49

AGRICULTURE.

Nemaha County was originally mainly prairie, with narrow forested areas along drainage ways. The first settlers located along the streams, where there was an abundant supply of water and fuel. Agricultural operations were begun in 1854. Vegetables were grown

for home use, and extensive areas were used for the production of corn, flax, and barley. Ranching was followed to some extent, but the live-stock industry never became important. Corn has always been the principal money crop of the county. Flax was second in importance until 1870, when, owing to decreased yields and low prices, it was superseded by spring wheat. As early as 1885 the production of spring wheat began to decline, owing to low yields and insect pests, and at present very little of it is grown, its place being taken by a variety of winter wheat known as the Turkey Red. Irish and sweet potatoes, rye, buckwheat, and flax were minor crops.

The following table, compiled from the census reports, shows the relative importance of the principal crops grown in the county in 1879, 1889, 1899, and 1909:

Relative importance of the principal crops grown in Nemaha County in 1879, 1889, 1899, and 1909.

Crop.	1879		1889		1899		1909	
	Acreage.	Production.	Acreage.	Production.	Acreage.	Production.	Acreage.	Production.
	Acres.	*Bushels.*	*Acres.*	*Bushels.*	*Acres.*	*Bushels.*	*Acres.*	*Bushels.*
Corn	66,982	2,942,770	85,575	4,084,020	107,049	4,238,000	82,680	2,117,421
Wheat	25,694	273,708	10,633	161,528	24,248	315,500	28,626	567,066
Oats	4,259	118,606	15,278	539,483	23,716	769,270	20,677	564,072
Barley	2,530	35,412	1,024	25,420	93	1,930	27	308
		Tons.		*Tons.*		*Tons.*		*Tons.*
Hay	9,807	13,650	20,255	32,654	13,020	25,802	24,194	39,538

At present the system of agriculture generally followed consists mainly of grain production in conjunction with dairying and the raising of live stock in a small way. Corn, wheat, oats, hay, and potatoes are the principal crops, ranking in the order named.

About 1 acre of corn is grown in the county to 1 acre of all other crops combined, approximately 38 per cent of the improved farm land being devoted to it. This is a lower percentage, however, than is devoted to corn in the northeastern part of the State. A production of 2,117,421 bushels from a total of 82,680 acres is reported in the 1910 census. There has been a decided decrease in the acreage of corn since 1910, with a proportionate increase in the acreage of wheat and hay.

Corn is grown on all the important soil types of the county, and does best on the silt loams. Reids Yellow Dent, Iowa Silver Mine, Leaming, and the Nemaha Valley White are the most popular varieties. On farms having silos from 10 to 15 acres are cut for ensilage, the fodder on the remaining acreage being used for fall and winter pasturage. Some farmers utilize the finer parts of the stalks for winter roughage.

On the upland soils the crop is usually planted 2 to 4 years in succession, while on the bottom land the period may extend to 20 years. Best results are obtained where it is planted not more than 2 years in succession on the same land, and is rotated with grain and leguminous crops. Most of the corn is listed and a small part of it is checkrowed. A few farmers use a loose-ground lister.

Wheat is second in acreage, a little more than 9 per cent of the improved farm land being devoted to it. The 1910 census reports a total of 28,626 acres in this crop, with a production of 567,066 bushels. At present the Turkey Red winter wheat is grown almost exclusively. This variety produces better yields than the spring wheats and can be seeded in the fall, when it does not interfere with the work of caring for other crops. It matures before the dry weather or hot winds occur. It is grown chiefly on the Marshall and Carrington silt loams and to a small extent on the bottom land. It does best on the Marshall silt loam. As a rule wheat follows oats in systematic crop rotations, and it usually is grown for 2 years, though sometimes the period is extended to 4 years or more. With the present high prices the crop is profitable, and it promises to continue as the leading small-grain crop. It is strictly a cash crop and is usually sold direct from the thrashing machine, though some farmers store part of the crop and sell when the prices are most favorable.

The acreage in oats is nearly as large as that in wheat, the 1910 census reporting a total of 20,677 acres, with a production of 564,072 bushels. Like wheat, this crop does best on the Marshall and Carrington silt loams. It is likely to lodge on the bottom-land soils. The Kherson, a short, stiff-strawed variety, has given the best results on the bottom lands. Other varieties grown in the county are the Swedish Select and Green Russian. As it is impracticable to follow corn with wheat, oats take this place in the rotation, regardless of the fact that the crop is less profitable than either corn or wheat. It is seldom grown on the same land for more than one year. The greater part of the crop is fed to horses, mules, and other live stock and only a small quantity is sold.

According to the 1910 census 23,194 acres were devoted to hay in 1909, from which 38,141 tons were harvested. Of the hay crops timothy and clover mixed occupy the largest acreage, 9,789 tons of such hay being cut from 7,968 acres in 1909. They are seeded with wheat as a nurse crop and the stand is usually maintained for two or three years. Timothy is usually sowed in the fall with the wheat and the clover broadcasted in the spring on the young wheat. Considerable clover is sowed alone, but it is thought best to add timothy in order to avoid an entire crop failure in case the clover fails. In late years it has been difficult to obtain a stand of clover. As a rule the rainfall between the middle of July and the middle of

September is not great enough to enable the delicate clover plants to withstand the extremely hot winds and occasional long droughts which occur after the nurse crop has been removed. If the rainfall is ample immediately after the cutting of the grain, when it is most needed, clover does well, yielding from 1½ to 2½ tons of hay per acre. Timothy alone is grown mainly for hay and to a small extent for seed. It yields from 1 to 1½ tons of hay or from 4 to 6 bushels of seed per acre. According to the Thirteenth Census, there were 2,212 acres in clover alone in 1909, with a production of 2,670 tons of hay, and 2,495 acres in timothy alone, with a production of 3,200 tons.

The census of 1910 reports 269 acres in millet or Hungarian grasses, 223 acres in other tame or cultivated grasses, 32 acres in grains cut green, and 1,000 acres in coarse forage.

The acreage of wild grasses is comparatively small. In 1909, 9,487 tons of hay were cut from 5,806 acres. Most of the wild hay is grown on the Little Nemaha River first bottom, with small fields scattered through other parts of the county. As practically all the virgin upland prairie has been broken and the lowland is being rapidly drained by extensive drainage systems, the growing of wild hay is rapidly decreasing. Most of the hay is stacked in the field, and as soon as time permits, if sold, it is baled and hauled to market. Where kept for feed, it is used from the stacks as needed.

Alfalfa does well on the soils of Nemaha County. Though introduced only about 15 years ago, it was grown on 4,189 acres, with a production of 12,170 tons, in 1909. The crop is grown mainly on the Knox, Marshall, Carrington, and Waukesha silt loams and to a small extent on the well-drained bottom-land soils. Usually three and sometimes four cuttings are obtained during a season, with total yields ranging from 2 to 6 tons per acre. The yields as a rule increase until the sixth or seventh year, when they decline rapidly, except where disking is practiced. Alfalfa usually follows wheat in the crop rotation, taking the place of clover, and the stand is maintained from five to seven years or longer. Most of the crop is fed on the farm, though a large part is sold through an alfalfa association. Most of that sold is shipped to St. Joseph and Kansas City. A price of $10 to $12 a ton in the stack ordinarily is realized.

Barley, rye, kafir, and sorghum are unimportant crops. Sorghum is grown both for sirup and for fodder. Kafir usually is fed without thrashing to horses and other live stock, though a few farmers feed only the fodder to live stock and the seed to chickens.

Nearly every farmer grows some vegetables for home use. Around the smaller towns vegetables are grown on a commercial scale to supply the local demand, which is not very large. In the vicinity of Brownville about 100 acres are devoted to tomatoes, which are used by the canning factory at that place. As a rule every farmer plans

to produce enough potatoes for home use. In favorable seasons there is a small surplus, which is sold at neighboring towns, while in dry seasons the farmers commonly buy potatoes. In general the potato patches receive little attention, and as a result the yields are very low. The 1910 census reports a total of 792 acres in potatoes, with a production of 73,653 bushels. A total area of 467 acres is reported in other vegetables. In the vicinity of Brownville watermelons are grown to some extent. They do well and the gross return per acre is about $320. Most of the watermelons are marketed in the neighboring towns at 15 to 25 cents apiece, depending on the size. Muskmelons do well, but very few are grown.

Small fruits thrive, but are not grown extensively. They are produced commercially in small patches near Brownville and Peru. Strawberries, raspberries, blackberries, gooseberries, and currants are the principal small fruits, and these are grown mainly on the Knox and Marshall silt loams. Strawberries do very well, and in one case a gross return of $2,000 from 3 acres is reported. In the vicinity of Brownville there are about 100 acres in strawberries, 100 in blackberries, 5 acres in gooseberries, and 5 in currants. There are only a few small patches of fruit in the vicinity of Peru. Two associations have been organized for handling the fruit.

Grapes are grown commercially in a small way on the Knox silt loam in the eastern part of the county. They do well and when properly cared for are a profitable crop. The average size of the commercial vineyards is about 3 acres. A total of about 50 acres in the vicinity of Peru and a total of about 100 acres at Brownville are devoted to grapes. Most of the grapes are marketed at Lincoln and neighboring towns. They are not sold through an association. The average net return is about $100 an acre.

Increasing attention is being given to the growing of apples, both commercially and in home orchards. Nearly every farmer has a small orchard in which apples and other fruits, such as pears, peaches, cherries, and plums are grown. Where properly cared for the farm orchards are successful, though many farmers do not give them the required attention, and as a result large numbers of trees are dying. Most of the commercial orchards are located in the bluff zone. The largest orchards are in the immediate vicinity of Brownville and Peru, there being about 1,000 acres in apples near the former place and 200 acres near the latter. A large number of orchards, mainly apple, with some pear, recently have been set out. The preferred locations are the north slopes along the bluff zone of the Missouri River and along minor streams. The apples are sorted and only the best fruit is marketed, the culls being used largely in the manufacture of cider and vinegar at Brownville. Culls bring from 25 to 28 cents per hundred pounds for cider and 40

to 50 cents for canning. The price of salable apples varies with the supply and demand. The average net return varies from $75 to $100 an acre. Most of the apples are marketed at different points within the State, and only a few are sold through an association.

The bearing commercial pear orchards are confined to the vicinity of Brownville, though a number of orchards are being set out at Peru. Pears do well, and their production could be profitably extended. At present there are 50 acres in bearing trees near Brownville.

Peaches are grown on nearly every farm, and yields are heavy in favorable seasons, but owing to the fact that the fruit buds are apt to be injured by late frosts, peaches can not be grown successfully on a large scale. There are about 30 acres in commercial peach orchards near Brownville. The value of fruits and nuts produced in the county in 1909 is given as $91,788 in the 1910 census.

Hog raising is the most important branch of the live-stock industry. On the average 30 to 50 hogs per farm are fattened each year for market, in addition to those slaughtered for home use. Some farmers feed as many as 100 head. The chief breeds are the Duroc Jersey, Poland China, Chester White, and Hampshire. A cross between the Poland China and Duroc Jersey is becoming very popular. Very few of the herds are purebred.

Dairying is an unimportant industry in the county, although it is being given increasing attention. There is scarcely any purebred dairy stock in the county. Most of the cows are of Shorthorn breed, although there are a few of Holstein and Jersey blood. In late years many purebred bulls have been introduced. The number of cows per farm ranges from 2 to 15, with an average of about 6. Some farmers keep merely enough to supply the family with dairy products, while others sell some cream. Most of the farmers separate the milk at home, and those who have a surplus ship the cream to creameries, either directly or through collecting stations. Where shipped direct it is sent mainly to St. Joseph, and where it is shipped through cream stations, to Omaha. A few farmers make butter for local markets, but it is said to be more profitable to ship the cream direct. Most of the cream is shipped in the summer. Very little attention is given to breeding, housing, ventilation, and the proper feeding of cattle on the average farm. There are only a few silos in the county, but the number is increasing.

As a rule a large number of farmers raise a few head of beef cattle every year and sell them when the prices are most favorable. On some of the large farms cattle obtained from the stockyards are fed for market. This industry is confined mainly to the bottom lands of the Little Nemaha River. Some feed as many as 4 carloads a year,

but the average is about one-half carload. The beef cattle are mainly Shorthorn and Hereford.

The raising of horses receives little attention. Most of the farmers raise 1 or 2 colts a year, and some as many as 6. The sires mainly used are Percheron, Shire, and Belgian, and the quality of the work stock is being gradually improved. A comparatively large number of mules are raised. These find a ready market.

The value of all live stock in Nemaha County is given as $1,025,130 in the 1910 census.

Poultry is raised on most of the farms, the usual number of chickens kept ranging from about 50 to 150. On many farms geese, ducks, turkeys, and guineas are kept. The value of poultry and eggs in Nemaha County is reported as $170,823 in the 1910 census.

As a result of the wasteful methods followed by the early farmers, the productiveness of the soils of this county was greatly reduced. Crops were grown on the same fields for a number of years in succession with as little cultivation as possible, and no attention was given to fertilization, seed selection, or the adaptation of crops to soils. When this condition became apparent farmers began to adopt methods of farming which would increase the productiveness of the soils.

Considerable attention is given to the adaptation of crops to soils. It is recognized that the smooth, upland areas are best adapted to corn, wheat, oats, and alfalfa; that the Wabash silt loam is best adapted to corn and not well adapted to small grains; that the Shelby loam is best adapted to grazing; that the steep areas of Marshall and Carrington silt loams are admirably adapted to alfalfa, commercial orchards, and small fruits, and that the sandy types are good soils for potatoes and other truck crops. The question as to which class of crops can be produced most economically on each soil type has been given very little attention.

While crops are commonly rotated, no definite system is followed, except by a few progressive farmers. The general tendency is to grow corn 2 to 4 years, oats 1 year, and wheat 2 years, returning to corn. Frequently corn is grown 10 years or more and wheat 4 years, but oats are rarely grown more than 1 year. The yields of both corn and wheat depreciate noticeably after the second year. Occasionally the wheat land is kept in clover and timothy for 2 or 3 years, or in alfalfa for 4 to 7 years, and then returned to corn. Clover and timothy fit best into a short rotation, but owing to the fact that alfalfa is a more certain crop, the growing of clover and timothy is decreasing. A rotation which is considered a good one by some of the best farmers in the county is 2 years of corn, 1 year of oats, 2 years of wheat, and 2 or 3 years of clover, returning to corn. On

farms where there is no permanent pasture the clover and timothy fields usually are pastured the last year.

Green crops are seldom turned under and little commercial fertilizer is used. As a rule only enough barnyard manure is available to fertilize the least productive spots on the farms. In 1909 the expenditure for commercial fertilizers was $127.

Efficient farm labor is rather scarce, and most of the work is done by the farmers and their families. Laborers usually receive $25 to $30 a month with board when hired by the year, and from $30 to $40 a month with board when hired from April 1 to December 1. The daily wage ranges from $1.50 to $2 or more, with board, during harvest time. Some farmers employ entire families in order to obtain more efficient and steadier help. The wage in such cases ranges from $35 to $40 a month, with the privilege of keeping a cow, horse, chickens, and a garden. As a rule the family is also supplied with fuel and some fruit. An expenditure of $169,408 for labor is reported in the 1910 census.

As a whole, the farms in Nemaha County present an appearance of general thrift and prosperity. As a rule the buildings are painted and kept in good repair. Most of the fences are of barbed wire, although woven wire is coming into general use. Hedge fences are common along the farm lines. The latter, however, are undesirable, owing to the stunting of crops within 10 to 15 feet of the hedge. Labor-saving machinery is in general use.

There are 236,850 acres in farms in Nemaha County, according to the census of 1910, of which 213,590 acres are improved. The average size of the farms is given as 150.4 acres, showing an increase of about 8 acres since 1880. There are many large farms in the county, most of them on the Little Nemaha River first bottoms. About one-half of the farms are operated by owners, the remainder being operated largely by tenants.

Both the cash and share systems and a combination of the two are used in renting farms. The share system apparently is the most common. Cash rent ranges from $3 to $6 an acre, depending on the nature of the soil. Under the share system the owner receives two-fifths, and in a few cases one-third, of the crops grown, all implements and stock being furnished by the tenant. In a few cases the owner receives two-fifths of the grain and one-half of the corn. Where the land is rented on the basis of an equal division of the crops the owner furnishes the implements and the work stock. The latter method is not practiced extensively. In the combination system of cash and share renting land not used for crops, including permanent pasture, is rented for cash and the grain and hay fields on shares. In some cases cash rent is paid for the hay land. In any

system of renting the tenant is required to deliver the grain to the elevator.

Farm land ranges in value from $30 to $175 an acre, depending upon the character of the soil, improvements, and location.

SOILS.

The soils of Nemaha County may be grouped into three distinct divisions—upland soils, derived from glacial and loessial material; alluvial terrace soils, derived from fluvial silts; and first-bottom soils, derived from recent stream deposits. The upland group embraces the Marshall, Grundy, Knox, Carrington, and Shelby series; the alluvial terrace soils are classed with the Waukesha series; and the first bottoms comprise the Wabash and Sarpy series and Riverwash. Most of the soils of the upland and terraces are silty and the same is true of most of the first-bottom types, except along the Missouri River, where the clay and very fine sandy loam are important. With the exception of the Knox series and the recently deposited soils along the Missouri River, the soils of the county are dark in color and rather high in organic-matter content.

The upland was originally covered with a very thick soil mantle, but through erosion the deposit has been practically worn away and only a few remnants of the original constructional surface are left. The most typical remnants are in the extreme western and northwestern parts of the county. The soil here is mapped as the Grundy silt loam. In areas where erosion has removed a large part of the original loess mantle, but the remnant retains loess characteristics, the soils weathered from it are classed with the Marshall series, and where the surface soil is eroded they are classed with the Knox series. Along the bluff line of the Missouri River the loess has been modified by material blown over it from the sand and silt bars of the valley. The loess has a massive, columnar structure and to a considerable extent is cemented with lime and iron. The color varies from buff or brownish yellow to pale yellow or light gray, and where thoroughly leached to almost white. Reddish iron stains and lime concretions are prominent in the formation. Westward from the bluff the loess generally becomes heavier in texture and more compact. The loess has a maximum thickness of 60 feet.

Below the loess-plains material lies the weathered phase of the Kansan drift, which gives rise to the Carrington silt loam. The loess and the weathered phase of the Kansan drift are very similar in character, but some fine distinctions may be pointed out. The weathered phase of the Kansan drift consists of brownish-yellow or yellow to grayish-yellow or light-gray, loesslike deposits with

numerous lime concretions and reddish iron stains. It has a vertical structure and is practically stone free, although it contains a very small quantity of large sand grains and small cobblestones. This deposit differs from the true loess in that it contains a little more clay, has a less pronounced vertical structure, and has a low content of sand and pebbles. In the soil derived from the weathered phase there is a slight concentration of clay in the upper part of the subsoil. There is no definite boundary between the loess and the weathered drift, but they grade imperceptibly into each other. As a result the boundary line between the Carrington and Marshall silt loams is largely arbitrary. Where pebbles are encountered the material is mapped as the Carrington silt loam, and where these are absent as the Marshall silt loam.

Below the weathered phase of the Kansan drift lies the Kansan drift proper. It has an irregular surface in the county, the form being largely determined by the eroded bedrock or uneven surface upon which it rests and the extent to which erosion has advanced since formation. There is a sharp line of separation in color and texture between the weathered phase of the Kansan drift and the Kansan drift proper. The upper part of the Kansan drift is thoroughly oxidized, showing that it has been subjected to weathering. Undoubtedly the weathered phase has been altered so much by wind action that it has lost its drift characteristics and has the appearance of the loess. The Kansan sheet is till and consists of a heterogeneous mixture of clay, silt, sand, cobblestones, and larger bowlders. The upper oxidized zone varies in color from yellowish brown or brown to reddish brown. Below this the drift sheet has a light-gray or pale-yellow color, with numerous iron stains, and is highly calcareous. Where the drift sheet has been subjected to excessive erosion it has given rise to the Shelby loam.

The Aftonian material lies below the Kansan drift, and consists largely of stratified sand and gravel, with a few bowlders. It is known to exist along the Missouri River, but does not form a continuous bed throughout the county. It does not give rise to any soil type, but may have contributed some material to areas of a sandy phase of the Shelby loam which are too small to be shown satisfactorily on the soil map.

The lowest drift sheet, the Nebraskan, is not well defined. The extent of its occurrence is not definitely known. The drift sheets rest on the Pennsylvanian beds of Carboniferous age. The lowest and oldest stratum of this formation is a thick bed, mainly of shales, exposed along the Missouri River. It carries seams of coal and sandy layers, but is chiefly indurated clay. Above this shale are three fairly well defined soft limestones varying from 2 to 5 feet in thickness. This

rock is quarried in a number of places. The limestone layers support a thick formation of 100 feet or more of shale, which in turn is overlain by a series of limestones and interbedded layers of shale. The upper cap of this limestone is the Cottonwood, which is exposed in places in the upland west and northwest of Auburn. It is a light-colored limestone and contains large quantities of fossils the size of rice grains. It has been quarried at a number of places in the county. The Pennsylvanian beds dip westward from the Missouri River to near Auburn, beyond which place they rise to Johnson.

The terraces of Nemaha County are entirely confined to the Little Nemaha River and consist of two series. The second terrace is about 60 feet above the flood plain, and is of later age than the loess plains. The first terrace is of still more recent origin. The terraces or benches are occupied by loess similar to upland loess. Whether the terraces are generally underlain by sand is not known. The loess covering gives rise to the Waukesha silt loam.

The alluvial deposits are rather extensive in Nemaha County. The largest areas occur along the Little Nemaha and Missouri Rivers. Along the Little Nemaha River and the small streams the alluvium consists largely of silt, with a slight admixture of clay, owing to the prevailingly fine texture of the soils from which the material is washed, though locally coarser material from the Kansan drift is present. This material is mapped as the Wabash. Along the Missouri River the deposit consists largely of alternate layers of very fine sand, silt, and clay. The alluvial deposits along the smaller streams are shallow, compared with those along the Missouri River. The light-colored soils underlain by a lighter textured subsoil are classed with the Sarpy series, and the black-colored soils with as heavy or heavier subsoils with the Wabash series. The recently deposited material occurring as sand bars is termed Riverwash.

The following table gives the names and the actual and relative extent of the various soils mapped in Nemaha County:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Carrington silt loam	108,864	42.3	Sarpy silt loam	2,432	1.0
Marshall silt loam	61,568	24.0	Grundy silt loam	2,240	.8
Wabash silt loam	50,624	19.7	Waukesha silt loam	2,176	.8
Shelby loam	9,472	3.7	Sarpy clay	832	.3
Knox silt loam	6,144	2.4	Sarpy fine sand	192	.1
Sarpy very fine sandy loam	4,544	1.8			
Riverwash	4,224	1.6	Total	257,280	
Wabash clay	3,968	1.5			

Marshall Series.

The Marshall soils are dark brown to black. The subsoils are yellowish brown and, as a rule, sufficiently calcareous to effervesce in acid. The texture remains about uniform throughout the subsoil layer and the structure is open and friable throughout. The types of this series differ from those of the Knox series in the relatively large quantity of organic matter in the surface soils. The topography is smooth to rolling and the drainage is good. The derivation is from loess. Only one member of this series is encountered in Nemaha County, the Marshall silt loam.

Marshall silt loam.

The Marshall silt loam consists of a prevailingly dark-brown silt loam, 10 to 18 inches deep, carrying a high percentage of silt. The soil has a velvety feel and is very friable and high in organic matter. It is underlain by a yellowish-brown, somewhat heavier, and more compact silt loam, the color becoming lighter with increasing depth. At a depth of 24 to 36 inches light-gray mottlings and reddish iron stains are encountered, though not infrequently the solid yellowish-brown color extends beyond 3 feet. The transitional layer between the soil and subsoil is usually brown and varies in thickness from 2 to 4 inches. The subsoil is open and friable and has a columnar structure. The lower part of the soil section and the deep subsoil are highly calcareous.

The depth of the soil is variable and depends upon its topographic position. In the flatter areas it is usually 15 to 18 inches deep, while on the sharp divides, steep slopes, shoulders of hills, and along gullies it has a depth of only 6 to 8 inches, and the yellowish-brown subsoil is frequently exposed. Areas where the subsoil is exposed are classed with the Knox silt loam, where large enough to indicate on the map. On the lower slopes the soil is deeper and darker in color, and at the foot of the slopes it commonly extends to a depth of 20 to 40 inches. The soil is deeper also in forested areas. The color of the subsoil varies from yellowish brown, yellow, or pale yellow to yellowish gray. The shallow areas of this type are largely developed in the bluff zone of the county. In general the soil is lighter in color and more friable and open along the Missouri bluff than away from it. Along intermittent streams this type includes small, narrow strips of colluvial material which are too small to be shown separately on the soil map.

Southwest of Howe there are a few areas having a gently undulating topography in which the soil is deeper than where typically developed, being 15 to 24 inches deep, while the subsoil is a heavy silt loam to silty clay loam. In some borings a hardpan layer was encountered. In small local areas the soil is a dark-brown heavy silt

loam to a depth of 15 inches, where a black, tough, moderately crumbly silty clay loam is encountered. At 24 to 36 inches the texture again becomes lighter and the color changes to brown.

The Marshall silt loam is the second most extensive upland soil in the county, covering 96.2 square miles. It occupies two large areas in the eastern part of the county, small areas in the bluff zone southwest of Howe, and a small area northwest of Johnson. In the bluff zone the type is associated with the Knox silt loam. In its western development it gives way to the Carrington silt loam.

The topography varies from slightly undulating to steeply rolling. In the western part of the county it is gently rolling, the steeper slopes being occupied by the Carrington silt loam. The areas southwest of Howe and the area northwest of Johnson occupy slightly sloping and comparatively broad divides. The type is well drained. Erosion, which is a serious factor on the steep slopes, is effectively checked by deep plowing and by keeping the land in cover crops as much as possible. Where the slopes are very steep the type is best utilized for grazing or hay land. The type originally was covered with a thick growth of prairie grass, but only a few scattered patches remain. In the bluff zone it is forested.

Practically all the type, except the steep slopes in the eastern part of the upland region, is under cultivation. Corn is the principal crop, and about one-half the improved land is devoted to it, the remainder being largely used for wheat, oats, and alfalfa. Corn ordinarily yields from 30 to 45 bushels per acre. In some cases yields of 70 bushels per acre are obtained in favorable seasons. Wheat ranks second in acreage and is being more extensively grown each year. In dry years it is preferred to corn, because it matures before the dry weather and hot winds occur. In normal seasons wheat yields from 20 to 30 bushels per acre.

The area in oats is almost equal to that in wheat. Oats do well, yielding from 40 to 45 bushels per acre. The acreage of clover and timothy and of alfalfa is small. In favorable years clover yields from 1½ to 2 tons of hay per acre. Owing to the high lime content and thorough drainage of this soil, alfalfa does very well, yields of 3 to 5 tons per acre being obtained from 3 or 4 cuttings. Some kafir is grown. A number of farmers grow small patches of millet, the yields ranging from 2 to 4 tons per acre. On an average about one-half acre of potatoes is grown on each farm for home use, with yields of 100 to 150 bushels per acre. There are a few patches of sorghum on the type. In the bluff zone where the slopes are steep and the type is not well adapted to grain farming commercial orchards and small fruits are receiving increasing attention. All orchard fruits and small fruits do well. Grapes, however, do better on the Knox silt loam than on this type.

Owing to the silty, friable, and stone-free character of this soil it is easy to handle. It does not bake or clod unless worked when very wet. Where properly cultivated it has a high water-holding capacity. The 4-horse hitch is used in practically all farm operations.

The value of the Marshall silt loam ranges from $125 to $175 an acre, depending on improvements and location. The steep slopes in the bluff zone are less valuable.

Grundy Series.

The soils of the Grundy series are prevailingly dark brown, ranging from black to brown. The lower part of the surface soil is lighter in color than the upper part, giving a suggestion of a subsurface gray layer. This feature is particularly noticeable in level areas. The transition from soil to subsoil is gradual. The upper subsoil is mottled and heavy. It is rather plastic when wet, and hard when dry. The mottling consists of dark drab and yellowish brown. The upper subsoil layer passes gradually into material of somewhat lighter texture and lighter color. The dark drab of the upper subsoil changes to medium drab, and the spots are less well defined, while the yellowish brown changes to yellow, making the color of the deeper subsoil yellowish gray. The topography is gently rolling. The soils are derived from a silt to silty clay layer overlying the Kansan drift sheet in Missouri, Kansas, Nebraska, and Iowa. The Grundy series is represented in Nemaha County by a single type, the silt loam.

Grundy silt loam.

The soil of the Grundy silt loam consists of a dark-brown to almost black, moderately heavy silt loam, 18 to 24 inches deep, with an average depth of 20 inches. It is high in organic matter and works up into a very mellow condition. The subsoil is a brownish silty clay loam, which passes abruptly into a grayish-yellow silty clay loam. At 24 to 30 inches the subsoil color changes to light gray, mottled with reddish iron stains. The subsoil has a decidedly granular structure and is compact, though not noticeably plastic.

A lighter textured and better drained variation of this type is developed in the extreme northwestern corner of the county. The soil, to a depth of 12 to 15 inches, is a dark-brown, smooth silt loam. It is very friable and apparently carries a high percentage of very fine sand. The subsoil is a brownish-yellow, heavy silt loam to silty clay loam.

The Grundy silt loam is very inextensive in this county, covering only 3½ square miles. The largest area occurs about 3 miles southwest of Johnson and another area in the extreme northwestern part of the county. It occupies high divides, undoubtedly representing

the original constructional surface, which is almost flat to slightly undulating. There are only a few streams, and those which cut back into the type are mere sags, although the drainage is adequate.

This type supports the same native growth and is used for the same crops as the Marshall silt loam. Corn yields 30 to 50 bushels and alfalfa 3 to 5 tons per acre. Owing to the flat topography, farm operations are more easily performed than on the Marshall silt loam.

The value of land of the Grundy silt loam ranges from $125 to $150 an acre.

Knox Series.

The Knox soils are light brown, overlying yellowish-brown to yellow, moderately calcareous subsoils. The texture of both soil and subsoil is usually uniform or essentially so throughout the section. The structure of the subsoil is friable. The derivation is from loess. These soils occur mainly in the Central Prairie States. The topography is rolling, and surface drainage is generally good. The silt loam is the only member of the Knox series encountered in this survey.

Knox silt loam.

The Knox silt loam is merely an eroded phase of the Marshall silt loam, and is more broken and dissected than the latter type. It consists of a yellowish-brown to light-brown silt loam, 4 to 6 inches deep, underlain by a brownish-yellow silt loam. Both soil and subsoil are friable, open, and columnar in structure. There is no apparent change in texture or structure within the 3-foot section. Not infrequently the subsoil is yellowish gray or yellow mottled with light gray. Reddish iron stains are common, and become more pronounced below the 3-foot section. The soil is almost devoid of organic matter and is stickier than the Marshall silt loam. The subsoil is highly calcareous, the lime occurring as concretions and to some extent as cementing material. Where erosion has been active, the light-gray subsoil, with its lime concretions, is exposed and has given rise to a whitish surface soil. In forested areas leaf mold has imparted a dark color to the immediate surface soil and on the lower slopes a dark soil has accumulated in many places to a considerable depth, largely as wash from the original dark surface soil of the higher slopes.

The Knox silt loam has a small total area in this county, and mainly occupies steep to precipitous slopes and sharp divides on the Missouri River bluffs, with a few outlying areas in the Marshall silt loam type. The valleys are deep and V-shaped, and in many places the slopes have the steplike configuration characteristic of the Missouri River loess. In others the topography is indicative of the soft, massive rock. The roughest areas occur in the southeastern part of the county. In the outlying areas the slopes are less steep.

The soil is thoroughly drained and, owing to its low organic-matter content, does not retain moisture as well as the Marshall silt loam. The type is subject to destructive erosion and great care is necessary in its cultivation.

With the exception of the outlying areas, this type originally was forested. The principal growth on the upper slopes was scrub oak, sumac, and hazel brush, and on the lower slopes and draws oak, elm, linden, hackberry, box elder, ash, bitter hickory, ironwood, Kentucky coffee tree, and black walnut. A large part of the type still supports a forest growth, though such land is slowly being cleared and devoted to fruit production.

About 35 per cent of the Knox silt loam is under cultivation, being used mainly for corn, oats, alfalfa, and fruits. Where the slopes are not too steep corn, oats, and alfalfa, with a small quantity of wheat, are the principal farm crops. Unless heavily manured, the grain yields are low. Ordinarily corn yields from 15 to 25 bushels an acre, oats 20 bushels, and wheat 15 to 20 bushels. Where alfalfa is started with a liberal application of manure it does well on this type. Three cuttings usually are obtained, with a total production of 3 to 4 tons per acre. In spots where the soil is dark the crop makes a rank growth. The acreage of alfalfa is being rapidly extended on this type, as on the steep slopes of the Marshall silt loam. Many farmers have as much as 100 acres in this crop. A large percentage of the alfalfa is sold. Dairying is better developed on this type than on the other soils of the county. In the vicinity of Peru and Brownville a considerable area is devoted to orcharding and the growing of small fruits. Apples and pears are grown on a commercial scale. Strawberries, raspberries, blackberries, gooseberries, and currants are profitable crops. Small vegetables, watermelons, muskmelons, and potatoes do well. On the upper slopes and higher situations grapes do very well, and their acreage is being gradually extended.

The general tendency is to put as much as is practical of this type, as well as of the steep slopes of the Marshall silt loam, into orchards and small fruits near the towns and into alfalfa on areas farther away. On most farms the land is kept in corn 2 years, in oats 1 year, and in alfalfa 5 years or more. The steepest slopes and bluffs are kept in permanent pasture.

Owing to its silty texture and open structure, this soil can be cultivated with ease and under a wide range of moisture conditions. Barnyard manure is liberally applied, though the practice of turning under green crops is not common. Very little commercial fertilizer is used. Crops respond readily to barnyard manure.

General farming land ranges in price from $40 to $60 an acre, depending on the topography and the distance from markets. Areas in orchards or small fruit are valued at $200 or more an acre.

CARRINGTON SERIES.

The soils of the Carrington series are generally dark brown to black. The subsoils consist of a yellowish-brown to yellow silty clay loam to silty clay. These types are derived through weathering from glacial till, with little or no modification from loessial deposits. The topography ranges from flat or gently undulating to rolling, and the drainage is good. Soils of this series are developed in the Central and Western Prairie States. The silt loam is the only type encountered in Nemaha County.

CARRINGTON SILT LOAM.

The Carrington silt loam consists prevailingly of a dark-brown, heavy silt loam, 8 to 15 inches deep, with an average depth of 12 inches. It is underlain by a thin transitional layer of brown silty clay loam, which passes into a yellowish-brown silty clay loam, the material becoming lighter in color with depth. Below 24 to 30 inches light-gray mottlings and rusty-brown iron stains frequently are encountered. The soil is friable and, as the color indicates, high in organic matter. The subsoil is granular and compact, and only slightly plastic. There is no abrupt change in color or texture from soil to subsoil. The soil does not stand up in vertical banks as do the loess soils. Lime concretions occur in the substratum, but rarely in the subsoil. On the rather flat divides the soil is deeper and the transitional layer between the soil and subsoil is thicker than usual, while on the shoulders of hills and along gullies the soil is a brown, heavy silt loam, 4 to 6 inches deep. At the foot of the slopes a large quantity of material washed from the higher lying land has been deposited, and the soil is a dark-brown to black, heavy silt loam varying in depth from 20 to 40 inches. Within areas of the type along intermittent streams there are small strips of colluvial material.

Where the Kansan drift proper is near the surface a shallow variation of this type is usually developed on the lower slopes. The soil is a dark-brown, very heavy silt loam to silty clay loam, 12 to 15 inches deep, underlain by a reddish-brown to reddish-yellow silty clay loam, which immediately passes into a compact, rather tough silty clay. The subsoil becomes lighter in color, though heavier in texture, and looser with depth. In the lower part gritty material frequently is encountered.

In places in the Carrington silt loam area, mainly near Auburn, the bedrock outcrops and produces another variation of the type. Such areas are very rough and stony and would be mapped as Rough stony land if of sufficient size to warrant their separation. They are indicated on the map by the conventional rock-outcrop symbol.

Owing to the similarity of the soil profile of the Carrington silt loam to that of the Marshall silt loam, the boundary line between

these types necessarily is largely arbitrary. They are identical in the color and depth of the soil and in the color of the subsoil. They differ in that the soil and subsoil of the Carrington silt loam are slightly heavier in texture and do not stand up so well in vertical banks. Typically, the Marshall silt loam breaks down to a fine powder, while the Carrington silt loam has a granular structure. Another difference is that the Carrington silt loam has a small content of sand and pebbles and occasionally bowlders. Where these types merge the soil boundary is based on the stone content.

The Carrington silt loam is the most extensive soil type in the county, covering 42.3 per cent of the total area. It occurs almost entirely as a single large area in the western section. Small areas occur east and southeast of Howe and in the northeastern part of the county. Along the major drainage ways this soil is associated with the Shelby loam. It has a rolling to steeply rolling topography. In the vicinity of Auburn and in the northern and northeastern part of the county the slopes are steepest. In sec. 1 and extending into sec. 2, T. 6 N., R. 12 E., and in secs. 16 and 17, extending a short distance into sec. 8, T. 5 N., R. 14 E., the topography is undulating to gently undulating and undoubtedly represents a slightly eroded high terrace. On the main divides the surface is rather gently sloping, but along the major stream courses the slopes are steep.

This type is well drained. On the steeper slopes erosion is serious, and numerous gullies are formed. Owing to its high clay content and its high percentage of organic matter, the soil is very retentive of moisture. Originally on the uplands it was covered with a thick growth of prairie grasses, and the lower slopes along the large drainage ways were forested.

Approximately 90 per cent of the Carrington silt loam is under cultivation, most of the remainder being in permanent pasture. Corn, the principal crop grown, yields from 30 to 40 bushels, and in favorable seasons as much as 60 bushels per acre. Wheat ranks second in acreage. It does well, and in dry years is the most certain crop. In normal seasons it yields about 25 bushels per acre. Oats do well, but are not nearly so profitable as wheat. The ordinary yields range from 30 to 40 bushels per acre. Alfalfa is receiving increasing attention and promises to become the leading hay crop on this type. Ordinarily three cuttings a season are obtained, with a total yield of 4 to 5 tons per acre. In favorable seasons clover and timothy do well, yielding from 1½ to 2 tons of hay per acre. A small area is in wild grasses, which produce from one-half to 1 ton of hay per acre. Some kafir and millet are grown for forage. Kafir yields from 4 to 6 tons of fodder per acre and millet 2 to 3 tons of hay. Potatoes do well, but are grown only for home use.

Owing to its higher clay content, the Carrington silt loam is more difficult to handle than is the Marshall silt loam and can not be cultivated under as wide range of moisture conditions. When plowed too wet it bakes and forms clods, which are rather difficult to reduce, although the soil never becomes very lumpy. Small checks and cracks form in this type, but these are not of sufficient extent to cause any serious loss of moisture by evaporation. Small quantities of manure are applied every eight to ten years, generally on the poorer spots. Where barnyard manure is applied as a top dressing on winter wheat a material increase in yields results.

The value of farm land of the Carrington silt loam ranges from $125 to $150 an acre, depending on improvements, topography, and location.

Shelby Series.

The Shelby soils are dark brown. The subsoils are composed of yellow, reddish-yellow, or light-brown, tenacious sandy clay. The subsoil frequently contains pipy iron concretions and streaks of calcareous material. The derivation is from sandy clay glacial drift old enough to be well weathered. Only one member of the Shelby series, the loam, is recognized in this county.

Shelby loam.

The soil of the Shelby loam consists of a dark-brown to brown loam to silty loam, 6 to 15 inches deep, carrying a rather high percentage of silt. It is underlain by a brownish, tenacious, gritty clay loam to clay, the color changing at 20 to 24 inches into yellow, mottled with light gray. Reddish iron stains and streaks of limy material are common in the lower subsoil. As a rule the subsoil becomes heavier and more compact and plastic with depth and gravel is encountered in increasing quantities, being sufficiently abundant in places to interfere with boring. Gravel and some bowlders are encountered in the surface soil, though generally not in quantities sufficient to prevent cultivation.

In the marginal areas adjoining the Carrington silt loam, and in areas where considerable silt washed from the higher lying silt loam types has been deposited, the dark-brown silt loam soil is underlain at 8 to 10 inches by a brown heavy loam to clay loam. At 20 to 24 inches a yellowish-brown, gritty clay loam, which becomes more compact and tougher with depth, is encountered. The subsoil of the Shelby loam frequently has a decidedly reddish shade, not a color due to oxidation, but one of material.

In places areas of sandy soil, not large enough to indicate as a separate phase, are developed. The soil of such areas is a brown fine sandy loam, 6 to 10 inches deep, underlain by an orange-colored or

rusty-brown, friable sandy clay. The large percentage of sand in the soil is undoubtedly due to exposed Aftonian material.

A shallow variation of this type is encountered in sec. 31, T. 6 N., R. 13 E., secs. 23, 24, 25, and 26, T. 5 N., R. 13 E., and secs. 10, 11, 14, and 22, T. 5 N., R. 14 E. The bedrock in this variation is very close to the surface, and areas in which it is exposed are indicated by rock-outcrop symbols. The slopes on which these areas occur are too steep and stony for cultivation, and they are utilized for permanent pasture.

The Shelby loam differs from the Carrington silt loam in having a rather high stone content within the 3-foot section, the Carrington silt loam being practically stone free. The type occurs as small areas throughout the Carrington silt loam, chiefly in the southwestern part of the county. It is usually developed along the steep slopes between the Carrington silt loam on the higher land and the Wabash silt loam on the bottom land. Drainage is thorough, except in places where the type receives considerable seepage water. The type is subject to destructive erosion, gullies 10 to 15 feet deep, with branching laterals, being common. Owing to the large proportion of clay in the subsoil, the type retains moisture well, though it is somewhat less retentive of moisture than is the Carrington silt loam.

The native vegetation consists of the prairie grasses common to the region. Along the larger drainage ways the lower slopes originally were forested, mainly with scrub oak. Where the forest growth has not been disturbed it has spread.

Only a small part of the type, about 20 per cent, is under cultivation, the remainder being largely in permanent pasture, with a small acreage in hay land. Where the slopes are moderate corn, wheat, and oats do well. Corn yields 20 to 30 bushels, oats 25 to 30 bushels, and wheat 15 to 20 bushels per acre. Some alfalfa is grown, with good results.

Owing to its high stone content, this soil is not so easy to handle as the Carrington silt loam. When plowed too wet it bakes and clods considerably, except in the sandy areas. In places, locally termed "gumbo" spots, where the subsoil is exposed the type checks and cracks and is very difficult to handle.

The value of this land ranges from $50 to $85 an acre, depending on the topography and the content of stony material.

Waukesha Series.

The surface soils of the Waukesha series are dark brown to black, and subsoils are yellow. They are derived from water-assorted glacial débris deposited in broad filled-in valleys or on outwash plains and terraces. The topography is mainly flat to undulating and drainage is good. The Waukesha silt loam is the only member of the series encountered in Nemaha County.

WAUKESHA SILT LOAM.

The Waukesha silt loam consists of a dark-brown, smooth silt loam, underlain, to a depth of 15 to 18 inches, by a yellowish-brown, heavy silt loam of slightly more compact structure. The subsoil becomes lighter in color with depth and occasionally light-gray mottlings and reddish iron stains appear in the lower part. There is very little change in texture and structure within the 3-foot section. The subsoil is open and has no apparent concentration of clay. On the marginal areas adjoining the upland the soil is 24 to 30 inches deep, owing to the addition of material washed from the higher lying silt loam types.

The soil profile of the Waukesha silt loam is similar to that of the Marshall silt loam, but the former type occupies flat or bench-like alluvial terraces, while the latter occupies rolling upland.

The Waukesha silt loam is inextensive in this county, and is confined to the first and second terraces along the Little Nemaha River. The largest areas occur between Auburn and Nemaha.

The topography of the first terrace is flat to gently undulating. The transition from the first terrace to the bottom land is marked by a gentle slope, and that between the second terrace and the bottom land by a rather steep slope. The second terrace is largely reduced to slopes, though it is rather flat topped. The low terrace is about 30 feet and the high terrace about 60 feet above the flood plain. In general the type is well drained but withstands drought well.

This type originally was covered with prairie grasses, but is now devoted to the production of the staple crops commonly grown in the county. On the high terrace the system of agriculture is similar to that followed on the Marshall silt loam. On the low terrace corn is the principal crop, and ordinarily yields from 40 to 50 bushels per acre. Wheat does well, producing 25, and occasionally 35, bushels per acre. Oats make a rank growth of straw and lodge, with the result that the yields are low. A large acreage is devoted to alfalfa. Three and sometimes four cuttings are obtained, with a total yield of 3 to 5 tons per acre. A large part of the alfalfa is sold to outside markets at a price of $10 to $12 a ton in the stack.

The general practice on this type is to keep the land in corn 3 to 5 years, in oats 1 year, in wheat 2 to 3 years, and in alfalfa 4 to 5 years. Where the land is very productive oats are not grown in the rotation.

Owing to its stone-free nature, smooth surface, silty texture, and friable structure, this type is easily handled. The 4-horse hitch is used for most of the farm operations.

The value of farm land on the Waukesha silt loam ranges from $140 to $160 an acre, depending on improvements and location. In the vicinity of Nemaha it has a considerably higher value.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of this type:

Mechanical analyses of Waukesha silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
371407	Soil	0.0	0.0	0.0	0.9	7.4	73.0	18.7
371408	Subsoil	.0	.2	.2	.4	6.4	72.8	19.9

WABASH SERIES.

The Wabash soils prevailingly are black, ranging to dark brown, and contain a high percentage of organic matter. The subsoils are gray or brownish gray. These soils are developed in the first bottoms of streams in the Central Prairie States. They extend for long distances along the Mississippi River. The material is derived principally from the loessial and associated soils of the region. The Wabash soils have a flat topography. Two members of the series, the silt loam and clay, are mapped in Nemaha County.

WABASH SILT LOAM.

The Wabash silt loam is a dark-brown to almost black, heavy silt loam, 12 to 18 inches deep, with an average depth of 15 inches. This is underlain by a black silty clay loam which becomes heavier and more compact with depth. Faint brown mottlings occur in the subsoil. Ditches on this type show that between the depths of 4 and 5 feet the substratum passes into a light-gray silt loam, streaked and blotched with reddish iron stains. Lime concretions are encountered in the light-gray layer. In poorly drained spots light-gray mottlings usually appear in the lower part of the subsoil. The soil is friable and high in organic matter. The subsoil is compact and moderately plastic, though the plasticity is not a pronounced characteristic. When dry the subsoil breaks down to granules.

On the narrow stream bottoms and in places on the wider bottoms a light variation of this type is developed. This is a smooth, dark-brown silt loam, 18 to 24 inches deep, underlain by a dark-brown, more compact silt loam. There apparently is no change in color and texture within the 3-foot section. In poorly drained spots light-gray mottlings and rusty-brown iron stains appear in the lower part of the subsoil. In texture this variation is lighter in the surface soil and considerably lighter in the subsoil than typical.

The area north of Peru in the Missouri River bottom, closely associated with the Wabash clay, is heavier in texture than the typical soil. It comprises a heavy silt loam, approaching a silty clay loam

in texture, 8 to 12 inches deep, underlain by a brown, mottled with lighter brown and gray, light-textured silt loam to very fine sandy loam. This stratum in turn passes abruptly into a dark grayish brown, heavy silt loam to silty clay loam. Practically all this heavy soil is under cultivation.

In the Little Nemaha bottom there are a number of areas of heavy soil which are locally termed "gumbo." The soil of such areas is a nearly black silty clay loam, 8 to 12 inches deep, underlain by a jet-black, moderately plastic silty clay loam. When dry, both soil and subsoil have a granular structure, though when wet they are sticky and the soil is like a clay. This phase is too irregular and patchy in occurrence to be mapped separately. It is best developed in the southeastern quarter of section 22, extending a short way into section 23; in an area covering the eastern half of the southeastern quarter of section 23, and extending into section 24, and in the western half of the northwestern quarter of section 25, reaching into section 26. All these sections are in T. 6 N., R. 13 E.

A colluvial phase is included with the Wabash silt loam. It consists of a dark-brown to black, heavy silt loam, extending to a depth of 3 feet without material change in texture or color. The subsoil is somewhat more compact, though very friable. This phase occurs largely as colluvial fans at the mouth of small streams entering the major first bottoms, and as gentle slopes between the bottom lands proper and the uplands or terraces. It is well drained and not subject to overflow, except for short periods by branch streams. Corn, oats, and wheat do well on this phase and most of it is devoted to corn.

The Wabash silt loam is the predominant bottom-land soil of the county. The largest area lies along the Little Nemaha River. The surface is flat and only slightly dissected by old channels and cut-offs. The type is subject to overflow. Originally the drainage as a whole was poor, but by deepening the channels and clearing the land it has been very much improved. There are still a number of poorly drained spots in the first bottom of the Little Nemaha River. This stream has been straightened by a deep ditch and the branch streams have been provided with laterals leading directly into the main channel. Before the maximum production of crops can be reached it will be necessary to install a complete system of drainage, including tiling and in many places the construction of additional ditches.

The narrow first bottoms and a narrow strip along the main streams originally were forested with white elm, oak, ash, linden, hackberry, maple, and some bitter hickory. Along the streams the growth also included cottonwood and willow. A large proportion of the original forest growth remains. On the wide bottoms the type supported a growth of marsh grasses and water-loving plants.

About 80 per cent of the type is under cultivation, being devoted to the production of the staple farm crops. Corn is by far the most important crop, being grown on about two-thirds of the improved farm land. Where not injured by overflow it yields from 40 to 50 bushels per acre, with maximum yields of 80 to 85 bushels. Where the type has been cultivated to corn for a number of years wheat does well, yielding from 20 to 30 bushels per acre. Oats are not grown extensively, as they make a rank growth and lodge. The Kherson, a short, stiff-strawed variety, does best, producing from 30 to 35 bushels per acre. Most of the type lies too low for the production of alfalfa, though in the better drained areas this crop does well. Usually four cuttings are obtained in a season, with an average total yield of 5 tons per acre. A large part of this type is in wild hay, producing 1½ to 2 tons per acre. Timothy does very well, yielding about 2 tons of hay per acre. The potatoes grown on this type are usually of inferior quality. Owing to the fact that this land affords good pasture and produces large yields of hay and corn, the raising of beef cattle is more general than on the upland.

The rotation practiced by a few of the best farmers on the Wabash silt loam consists of corn 3 years, oats 1 year, and wheat 1 year, returning to corn. On most farms the one-crop system prevails, and only occasionally is the corn rotated with oats and wheat. Some fields have been in corn continuously for 15 years or more.

Under proper moisture conditions the soil is rather easy to handle, though not so easy as the upland types. When wet it is rather sticky. and if plowed in this condition bakes and clods. The "gumbo" spots are difficult to till. Owing to the high water table and the friable nature of the soil, crops rarely suffer from lack of moisture.

On account of its high organic-matter content, the application of barnyard manure is not desirable on this type, except in fields which have been cultivated for a long time, as it causes small grain to lodge. In the cultivated areas the occasional rotation of corn with grain and some leguminous crop seems to be sufficient to maintain the productiveness of the soil. Where the type has been planted to corn continuously for an extended period its crop-producing power has been greatly impaired.

Farm land of this type ranges in value from $100 to $150 an acre, depending on drainage conditions and location.

WABASH CLAY.

The Wabash clay is a dark slate colored to almost black, heavy, plastic silty clay to clay, from 12 to 18 inches deep, underlain by a drab, faintly mottled with brown and rusty brown, plastic silty clay to clay. When dry, both soil and subsoil have a granular structure.

The change in color from the soil to the subsoil is gradual and usually marked by a dark-drab transitional layer, varying from 4 to 6 inches in thickness. As a rule the subsoil becomes lighter in color and texture with depth. It is highly calcareous, the lime occurring in the form of concretions and shells. Adjoining the bluff line the soil usually has a veneering of silty material and adjoining the Sarpy very fine sandy loam a veneering of very fine sandy material. This type is referred to locally as "gumbo."

In depressed areas the Wabash clay is subject to some variation, the soil consisting of a black, silty clay to clay, 3 to 5 inches deep, underlain by a bluish-gray, mottled with brown and rusty-brown, subsoil of the same texture. This variation is very poorly drained and is inundated a large part of the year. The natural growth largely consists of water-loving plants, and the type does not afford very good pasturage.

The Wabash clay occurs as first bottoms along the Missouri River, usually adjoining the bluff line, and has a small total area. The largest areas occur north and northwest of Peru and east and northeast of Nemaha.

The topography is flat to depressed, but on the whole the drainage is fair. The poorly drained areas are indicated on the map by marsh symbols. The establishment of good drainage is the greatest problem which confronts the farmers on this type. With the installation of a complete drainage system most of the type could be made valuable farming land.

About 50 per cent of this type is devoted to the production of staple crops, the remainder being largely in permanent pasture, with a small percentage in hay lots. Most of the fairly well drained areas of the type are in corn, which generally yields about 40 bushels per acre. Wheat ordinarily yields from 15 to 20 bushels per acre, while in dry seasons yields of 30 to 35 bushels are obtained. Oats are likely to lodge. The yields range from 25 to 40 bushels per acre. Some of the type is in wild grasses, which give average yields of 1½ tons of hay per acre. In well-drained areas alfalfa does well, yielding from 3 to 5 tons per acre.

The type is the most difficult soil to cultivate in Nemaha County. When cultivated too wet it forms intractable clods, though under favorable moisture conditions it works up into a rather mellow seed bed. Very little barnyard manure is applied and no commercial fertilizers are used. The one-crop system prevails on the Wabash clay, though occasionally corn is rotated with oats and wheat. Some of the land has been in corn for more than 10 years.

Land of this type is valued at $40 to $100 an acre, depending on drainage conditions and location.

SARPY SERIES.

The soils of the Sarpy series are light brown to brown, overlying lighter colored and lighter textured subsoils which often effervesce in acid. This series is developed in the bottoms of the Mississippi and Missouri Rivers and their tributaries. The material is alluvial in origin. Owing to their low position these soils are subject to overflow, although the nature of the soil and subsoil is such that between the flood stages of the streams drainage is good. In general the topography is flat. In Nemaha County the Sarpy series includes four types—the silt loam, very fine sandy loam, clay, and fine sand.

SARPY SILT LOAM.

The soil of the Sarpy silt loam consists of a light-brown to brown silt loam, 12 to 15 inches deep, carrying a high percentage of very fine sand. This is underlain by a very fine sandy loam, which has a light-gray color, mottled faintly with rusty brown. Frequently the subsoil has a bluish shade. Seams of very fine sand are common in the soil, and seams of silt and heavier material in the subsoil. As the color indicates, the soil is low in organic matter.

This type is inextensive and occurs as small areas in the Missouri River bottom lands. It is closely associated with the Sarpy very fine sandy loam, and like that type is elevated about 8 to 15 feet above the normal flow of the stream. In general, the surface is flat, though marked by slight ridges. The type is well drained and is rarely overflowed, except by branch streams. In a few places where it borders the Missouri River it is subject to stream erosion.

Practically all of this type is under cultivation. Most of it is devoted to corn, which yields from 50 to 70 bushels per acre when not injured by overflow. Oats and wheat also are grown successfully. Potatoes, watermelons, and muskmelons do well.

The value of this type ranges from $50 to $175 an acre, depending on the extent to which it is subject to erosion by the Missouri River.

Results of mechanical analyses of samples of soil and subsoil follow:

Mechanical analyses of Sarpy silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
371421	Soil	0.0	0.0	0.0	0.9	10.5	73.4	15.0
371422	Subsoil	.0	.1	.1	6.9	56.5	29.5	6.4

SARPY VERY FINE SANDY LOAM.

The Sarpy very fine sandy loam consists of a light-brown to brownish-gray very fine sandy loam, which becomes coarser with depth.

The soil carries a high percentage of silt and is low in organic matter. In many borings there is no apparent change in texture within the 3-foot section. In poorly drained positions the color of the subsoil at 20 to 24 inches changes to light gray mottled with rusty brown or brown. In many instances the subsoil consists of alternate layers of sand, silt, and clay, and seams of silt are not uncommon in the surface soil.

The Sarpy very fine sandy loam is not extensive in Nemaha County. The largest area is on McKissock Island. Other areas occur as narrow, discontinuous strips along the Missouri River, lying from 8 to 15 feet above the normal flow of the stream.

The surface generally is flat, though marked by slight ridges. Between flood stages the drainage is thorough to excessive and during protracted droughts crops suffer from lack of moisture. The type is subject to overflow.

Most of this type is under cultivation and devoted to the production of corn, oats, and wheat. About 10 per cent of it supports a thick growth of willow and cottonwood. Corn is the principal crop and yields from 30 to 50 bushels per acre. Oats and wheat do fairly well, but are not grown extensively, except on McKissock Island. Potatoes, watermelons, muskmelons, tomatoes, and other truck crops do very well, but are mainly grown only for home use.

This soil is very easy to handle, and can be worked under a wide range of moisture conditions. It forms small clods when plowed too wet, but these are easily reduced. Very little manure is applied and no commercial fertilizers are used. Crops respond readily to applications of manure, the yields being increased from 25 to 50 per cent.

As in the case of the Sarpy silt loam, the value of this land depends upon the extent to which it is subject to erosion by the Missouri River, and ranges from $40 to $150 an acre.

Below are given the results of mechanical analyses of samples of the soil and subsoil of the Sarpy very fine sandy loam:

Mechanical analyses of Sarpy very fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
371401	Soil	0.0	0.2	0.2	20.6	52.4	20.1	6.8
371402	Subsoil	.0	.1	.2	40.3	44.0	12.7	2.8

SARPY CLAY.

The soil of the Sarpy clay is a drab, plastic, silty clay, ranging in depth from 12 to 20 inches. It has a decidedly yellowish tinge and is faintly mottled with brown. The subsoil is a light-gray, mottled

with yellow, red, and rusty-brown, very fine sandy loam, which becomes coarser with depth. Seams of very fine sandy loam are common in the soil and seams of silty clay in the subsoil, the rusty-brown mottlings being more common in the latter. Decayed organic matter and driftwood occur in places throughout the soil section. The type as a whole, however, is low in organic matter.

The Sarpy clay is inextensive and occurs in recently abandoned stream channels in the first bottoms of the Missouri River, lying about 6 to 8 feet lower than the Sarpy very fine sandy loam and silt loam. It is poorly drained and subject to annual overflow.

Most of the type supports a young growth of willow and cottonwood. On account of its low-lying position, it is utilized only for pasturage. The value of this land ranges from $30 to $50 an acre. Results of mechanical analyses of samples of soil and subsoil follow:

Mechanical analyses of Sarpy clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
371419	Soil	0.0	0.0	0.0	2.1	5.2	37.1	55.4
371420	Subsoil	.0	.1	.0	11.9	52.8	28.2	6.6

SARPY FINE SAND.

The Sarpy fine sand consists of a light-gray to light-brown loamy fine sand, underlain by a light-gray, loose, incoherent fine sand which becomes coarser in texture with depth. The subsoil is more or less stained with iron.

This type is very inextensive and is developed on McKissock Island. In general the surface is flat, though ridgy. The water table is within 4 feet of the surface. Between high stages of the stream the type is excessively drained.

Corn, sorghum, and alfalfa do fairly well on this type. As the soil is low in organic matter, crops respond readily to barnyard and green manure. This land is valued at $20 to $40 an acre.

MISCELLANEOUS MATERIAL.

RIVERWASH.

The areas mapped as Riverwash consist mainly of sand bars and silty flats along the Missouri River. The total area of Riverwash is not large. It lies but a few feet above the normal flow of the river and is inundated with each slight rise of the stream. It is changed by every overflow, and even during normal stages of the stream the soil is constantly being washed away in some places and

built up in others. The material is influenced by wind erosion and is practically devoid of vegetation.

SUMMARY.

Nemaha County is located in the southeastern part of Nebraska. It comprises an area of 402 square miles, or 257,280 acres. The topography ranges from almost flat to rough and extremely dissected.

The lowest elevation, 880 feet above sea level, occurs in the extreme southeastern corner of the county and the highest, about 1,320 feet above sea level, southwest of Johnson at the county line.

The county is drained by three principal streams, the Missouri and Little Nemaha Rivers and tributaries of the Big Nemaha River. The general direction of the drainage is to the southeast.

The first permanent settlement in Nemaha County was made in 1854, and the county was organized in 1855. The population is given in the 1910 census as 13,095. Auburn, the county seat, is located near the center of the county and has a population of 2,729.

The county has good transportation facilities, every point being within 10 miles of a railroad station. All communities enjoy the advantages of rural free mail delivery and telephone service.

The climate is favorable for the production of general crops, such as corn, wheat, oats, and alfalfa. The mean annual precipitation is 35 inches and the mean temperature 51° F.

Grain farming is the principal type of agriculture followed, though increasing attention is being devoted to the production of beef, pork, and dairy products. Corn, wheat, oats, timothy, clover, wild grasses, and alfalfa are the principal farm crops, and potatoes, barley, rye, kafir, and sorghum are also grown to some extent. Truck crops are produced on a small scale. In the eastern part of the county some attention is given to orcharding and small-fruit growing.

No definite and systematic crop rotation is in general use, and the adaptation of crops to the various soils of the county has not been carefully studied.

Excluding Riverwash, 12 soil types, representing 8 series, are recognized in Nemaha County. They are classed in three groups—upland soils, terrace (old-alluvial) soils, and first-bottom (recent-alluvial) soils.

The Marshall silt loam is a dark-colored loess soil occurring largely in the eastern part of the county. It is considered the best upland soil for grain farming. Corn, wheat, and oats are the principal crops grown on it.

The Grundy silt loam is a very inextensive upland type, and is used for the same crops as the Marshall silt loam.

The Knox silt loam is a light-colored loess soil. It occurs chiefly in the bluff zone along the Missouri River. Owing to its steep topography it is not well adapted to grain farming. It is, however, well suited to apples.

The Carrington silt loam is glacial in origin and is the predominant upland soil in the county. It is considered a good agricultural soil and is largely utilized for the production of corn, wheat, and oats. It is very similar to the Marshall silt loam.

The Shelby loam is glacial in origin and is derived from the Kansan drift sheet proper, which gives rise to a rather stony soil. It is largely used for grazing land, although where the slope is not too steep and the stone content is low corn, oats, and wheat do well.

The Waukesha silt loam belongs to the terrace group of soils, and is entirely confined to the Little Nemaha Valley. It is an excellent farming soil, and corn, wheat, oats, and alfalfa are the principal crops grown on it.

The Wabash silt loam is the predominant first-bottom soil of the county. It is the best corn soil in the county, but is not nearly so well adapted to wheat and oats as to corn.

The Wabash clay is rather limited in extent. The well-drained areas of this soil are devoted to grain farming and the poorly drained ones to pasturage and hay. This type is more difficult to till than any other reclaimed soil in the county.

The Sarpy silt loam is very inextensive and is confined to the Missouri River first bottoms. Corn is the principal crop, and oats and wheat are grown to a small extent.

The Sarpy very fine sandy loam is found in the Missouri River first bottoms. Practically all the type is under cultivation and it is mainly devoted to the production of corn.

The Sarpy clay occurs in recently abandoned stream channels in the Missouri bottoms. None of the type is reclaimed, and it is largely used for pastures.

The Sarpy fine sand occurs in a single area on McKissock Island. It produces fair crops of corn, sorghum, and alfalfa.

Riverwash consists largely of sand bars and silty flats along the Missouri River, and is practically devoid of vegetation.

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U. S. DEPT. OF AGRICULTURE
BUREAU OF SOILS
MILTON WHITNEY, CHIEF
CURTIS F. MARBUT, IN CHARGE SOIL SURVEY

SOIL MAP
NEBRASKA
NEMAHA COUNTY SHEET

NEBRASKA SOIL SURVEY
G.E. CONDRA, DIRECTOR
UNIVERSITY OF NEBRASKA

SOIL PROFILE
(3 feet deep)

- Wabash silt loam: Sil; Sicl
- Wabash clay: Sic to C; Sic to C
- Sarpy fine sand: Lfs; Fs
- Sarpy very fine sandy loam: Vfsl; Vfsl
- Sarpy silt loam: Sil; Vfsl
- Sarpy clay: Sic; Vfsl
- Marshall silt loam: Sil; Sil; Sil
- Grundy silt loam: Sil; Sicl; Sicl
- Knox silt loam: Sil; Sil
- Carrington silt loam: Sil; Sicl; Sicl
- Shelby loam: L; Cl to C; Cl to C
- Waukesha silt loam: Sil; Sil

LEGEND

Sil —Silt loam
Sicl—Silty clay loam
L —Loam
Cl —Clay loam
C —Clay
Sic —Silty clay
Vfsl —Very fine sandy loam
Lfs —Loamy fine sand
Fs —Fine sand

Curtis F. Marbut, Inspector in Charge
Soils surveyed by A.H. Meyer, M.W. Beck, E.H. Smies and R.R. Burn of the U.S. Department of Agriculture and L.T. Skinner and W.A. Rockie of the Nebraska Soil Survey

BASE MAP IN PART FROM U.S. GEOLOGICAL SURVEY SHEETS

Scale 62500
1 0 1 2 3 4 Miles
1 0 1 2 3 4 5 Kilometers
Contour interval 20 feet.
Datum is mean sea level.

A. Hoen & Co. Lith. Baltimore, Md.

Field Operations
Bureau of Soils
1914

LEGEND

- Wabash silt loam (W)
- Marshall silt loam (Ml)
- Wabash clay (Wc)
- Grundy silt loam (Gs)
- Sarpy fine sand (S)
- Knox silt loam (K)
- Sarpy very fine sandy loam (Sf)
- Carrington silt loam (Cl)
- Sarpy silt loam (Ss)
- Shelby loam (Sl)
- Sarpy clay (Sc)
- Waukesha silt loam (Wl)
- Riverwash (R)

CONVENTIONAL SIGNS

CULTURE
(printed in black)

City or Village, Roads, Buildings, Wharves, Jetties, Breakwater, Levee, Lighthouse, Fort.
Secondary roads and Trails
Railroads Steam and Electric
Bridges, Ferry
R. R. crossings, Tunnel
Ford, Dam
School or Church Cemeteries
Mine or Quarry Mine dumps Made land
Bluff, Escarpment, Rock outcrop and Triangulation station
Stony and Gravelly areas
Soil boundaries
Boundary lines
Boundary lines
Boundary lines
U. S. township and section lines

RELIEF
(printed in brown or black)

Contours Depression contours
Prominent Hills Mountain Peaks
Sand, Wash, and Sand dunes
Shore and Low-water line, Sandbar

DRAINAGE
(printed in blue)

Streams
Lakes, Ponds, Intermittent lakes
Intermittent streams
Springs, Canals and Ditches, Flumes
Swamp Salt marshes
Submerged marsh Tidal flats

The above signs are in current use on the soil maps. Variations from this usage appear in some maps of earlier date.